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Treating Beet Root for the Manufacture of Vinegar.

LETTERS PATENT to William Armand Gilbee, of No. 4, South Street, Finsbury, London, and 39, Rue de l'Echiquier, Paris, in the Empire of France, Patent Agent, for the Invention of "**IMPROVEMENTS IN TREATING BEET ROOT FOR THE MANUFACTURE OF VINEGAR.**"—A communication.

Sealed the 10th March 1857, and dated the 30th December 1856.

PROVISIONAL SPECIFICATION left by the said William Armand Gilbee at the Office of the Commissioners of Patents, with his Petition, on the 30th December 1856.

I, WILLIAM ARMAND GILBEE, of No. 4, South Street, Finsbury, London, 5 and 39, Rue de l'Echiquier, Paris, in the Empire of France, Patent Agent, do hereby declare the nature of the said Invention for "**IMPROVEMENTS IN TREATING BEET ROOT FOR THE MANUFACTURE OF VINEGAR,**" to be as follows, that is to say:—

The Invention communicated to me consists in processes, first, for treating 10 beet root for the production of the vinous liquid; secondly, in converting the vinous liquid into vinegar.

I employ two methods of producing the vinous liquid: first, it may be made without defecation; secondly, with defecation.

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1st Process by Defecation.—The beet root being washed with care is rasped, then submitted to pressure; the juice thus obtained is introduced into a copper kept at a temperature of 85° to 90° centigrade, I then add about two pints of tannin at the temperature of about 8° centig. to a hundred pints of beet root juice. After having added the tannin, and whilst the liquid is in ebullition, it is necessary, in order to complete the defecation, to add about 16 dwts. sulphuric acid at 66° centig. diluted in about seven ounces of water per one hundred pints of juice, and by means of that addition the defecation is completed.

The filtering is performed as in the manufacture of sugar, and the juice is introduced into a copper on an evaporating apparatus to bring it to the required degree of density, and the evaporation is stopped at 10° or 11° Baumé. A second filtering is effected by means of filters of the kind used in sugar refineries, then the liquid is put into cooling tubes similar to those used by brewers. When the liquid has come down to 20° or 21° centig. about four ounces of tartaric acid are added to it, then it is left to ferment in a vat containing about six thousand pints of juice; lastly, twelve pounds of yeast previously diluted carefully in a little warm water are added to it. Each of the fermenting vats is provided with a lid, having a trap-door, which opens at will and allows the operation to be watched. When the density of the juice, previously equal to ten or eleven degrees Baumé, for instance, comes down to one degree the fermentation is at an end. The vinous liquid should then be drawn off and put into casks, by preference casks which have previously contained alcohol, containing from six hundred to seven hundred pints.

2nd Process without Defecation.—The juice obtained, as before described, is allowed to ferment with a small quantity of yeast. Fermentation having once set in, fresh juice is added, so as not to disturb the process of fermentation. When the vat is full enough, half the must of fermentation is transferred by means of a tubes into a second vat, the adding of the must is continued, and half the second vat is transferred into a third. The same operation is gone through with the third as with the two former ones, and the must comes into the fourth vat to complete the fermentation. When fermentation is over, and only a small quantity of sugar remains unconverted into alcohol, the vinous liquor is drawn off, and the matters in suspension are allowed to settle until they may be exposed without danger to the acetic fermentation, then only about thirty-two dwts. of chloride of sodium per one hundred pints are thrown into the vinous juice.

Acidification of the Vinous Juice.—I introduce the juice obtained and prepared as before stated into an apparatus in which the acetic fermentation is to

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take place. This apparatus is composed of a cylindrical cask, about six feet high, three feet in diameter, standing on one end. At about six inches from the lid is a bottom, pierced with several small conical holes, and supported by a hoop fastened inside the cask by pegs. In each of the holes this double bottom is fixed a piece of string, half closing the orifice, and held by a knot. The liquid, which enters through a tube between this bottom and the lid, leaks along these strings and drips into the interior of the cask, which is filled with chips of beech tree previously acidified with concentrated vinegar, and on which the liquid falls and spreads itself and is rapidly acidified. In some cases, instead 10 of chips, corn steeped in vinegar for forty-eight hours is employed, being placed in layers six or seven inches thick upon five or six horizontal diaphragms pierced with holes. The air is made to enter through openings made horizontally one inch or two above the real bottom of the cask, which penetrates through the chips, and egresses from the cask through an opening made in the lid, and 15 which serves also to let in the alcoholic liquid. In order to obtain a complete acidification, the liquid must generally pass three times through these casks. The vinegar thus obtained is put into large vats containing chips of beech tree previously acidified. They are then filled up and hermetically closed, and after having settled for twenty to twenty-five days it is put into small casks.

20 **SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said William Armand Gilbee in the Great Seal Patent Office on the 19th June 1857.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM ARMAND GILBEE, of No. 4, South Street, Finsbury, London, and 39, Rue de 25 l'Echiquier, Paris, in the Empire of France, Patent Agent, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twentieth day of January, in the year of our Lord One thousand eight hundred and fifty-seven, in the twentieth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said 30 William Armand Gilbee, Her special license that I, the said William Armand Gilbee, my executors, administrators, and assigns, or such others as I, the said William Armand Gilbee, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might 35 make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for

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"**IMPROVEMENTS IN TREATING BEET ROOT FOR THE MANUFACTURE OF VINEGAR,**" communicated to me from a foreigner residing abroad, upon the condition (amongst others) that I, the said William Armand Gilbee, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be 5 performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the Letters Patent.

NOW KNOW YE, that I, the said William Armand Gilbee, do hereby declare the nature of the said Invention, and in what manner the same is 10 to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say:—

The Invention communicated to me consists, first, in treating beet root for the production of the vinous liquid; secondly, for converting the vinous liquid and vinegar.

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I will first describe the mode in which I make the vinous liquid from beet root, and then how I convert the vinous liquid into vinegar.

There are two modes of making wine from beet root. It may be made without defecation, but the most advantageous mode is to defecate by the following process:—

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First Process by Defecation.—The beet root is first washed with care, then rasped, and pressed with celerity. The defecation may then be effected continuously. The liquid pressed out of the rasped beet root is made to fall into a boiler kept at a temperature of one hundred and eighty-five to one hundred and ninety-four degrees Fahrenheit, and provided with a stop-cock, through 25 which the liquid runs off after receiving the required treatment. Defecation is generally effected by means of lime, which is an indispensable agent to perfect defecation; but as a partial defecation only is required for my purpose, I make use of tannin, which removes the nitrous matters, and leaves the saline matters behind. I add a lye of tannin at a temperature of forty-six degrees 30 Fahrenheit in the proportion of three and a half pints to twenty-two gallons of juice, which is poured into the juice when coming from under the press, so that the juice arrives with it in the boiler. After having added the tannin, and whilst the liquid is in ebullition, it is necessary to add about six drams apothecaries weight of sulphuric acid at sixty-six degrees Beaumé diluted in 35 about seven ounces, (apothecaries weight) of water per twenty-two gallons of juice. The sulphuric acid takes up the saline bases of the beet root and forms salts favourable to the fermentation and conservation of the vinous liquid. For greater security, when the liquid has been scummed, a small quantity of

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carbonate of lime mixed with water may be added; this, however, is not necessary. This process of purifying beet root juice entirely removes the bad taste, although the result is rendered more certain after a quarter of an hour's ebullition on a worm heated by steam. The filtering is next performed as in 5 sugar refineries, or by any other suitable process, and the juice is then forced to pass into a boiler over an evaporating serpentine to bring it to the required degree of density, and in order to render the liquid strongly vinous, the evaporation is stopped at ten or eleven degrees Baumé. A second filtering is effected by means of the same kind of filters, then the liquid is passed into 10 cooling tubs of the kind used by brewers. When the liquid has come down to sixty-eight or seventy degrees Fahrenheit, about three and three-quarter drams (apoth.) of tartaric acid are added; it is then set to ferment in a vat containing about one thousand three hundred gallons of juice; finally, about thirteen pounds of yeast diluted carefully in a little warm water are added. 15 In cold weather it is desirable to raise the temperature of the juice to one hundred and eighty or one hundred and eighty-two degrees Fahrenheit, which additional heat may be supplied from the heat of the smoke, usually lost, which is made to pass under a long flat boiler, by adapting to a tube which conveys the juice to the vats another tube, forming a double envelope, and 20 serving for the return of water, or for bringing back to the boilers the condensed vapors; or by the combination of the three means, by the employment of the smoke, the lost vapors, and the water of condensation. Each of the fermenting vats is provided with a lid, having a trap-door, which opens at will, and allows the operator to watch the progress of the action, and ascertain, by 25 means of a prover and Baumé's areometer, the diminution of the density of the juice, which diminution shews the gradual developement of the alcohol. When the density of the juice, previously equal to ten or eleven degrees Baumé, for instance, comes down to the density marked by one degree of the areometer, it shews that the fermentation has come to an end. The wine 30 should then be drawn off into casks of a capacity of one hundred and thirty to one hundred and fifty gallons, casks having previously contained alcohol being preferred. As fermentation may last three or four days, if two vats are filled each day, eight or ten vats should be provided, so as to have one always ready to receive the wort, and a spare one, in case of accident. When the 35 contents of the first vat are ready, the liquid is drawn off, leaving at the bottom the deposit, which will serve as a leaven for a subsequent operation. Should the alcoholic fermentation become tumultuous, and bubbles of carbonic acid gas be heaped upon the surface of the liquid, forming a thick froth; it will be necessary to keep an empty space in the vat sufficiently deep to

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allow room for it. The froth may be reduced or wholly removed by the addition of a sufficient quantity, about a pint, of a solution of green soap, thrown on by a broom or other suitable means upon the surface of the liquid without allowing the bubbles to accumulate. The acidity of the juice saturates the alkali of the soap, and sets free the greasy or oily acid combined with it. The oily matter being spread over the surface, causes the gaseous bubbles to glide over each other and facilitates their bursting.

Second Process without Defecation.—The washing, rasping, and pressing should be effected with the same care as in the first process. The juice obtained is put to ferment with a small quantity of yeast. Fermentation having once set in, a fresh quantity of juice is added, but so as not to disturb the ferment. When the vat is sufficiently full half of the wort of fermentation is transferred by means of a tube into a second vat; the addition of wort is continued, and half the second vat is transferred into a third vat. The same operation takes place with the third as with the two former vats, and when the wort enters the fourth vat the fermentation is completed. When the fermentation is over, and there only remains a small quantity of sugar to convert into alcohol, the vinous liquor is drawn off, and the matters in suspension are allowed to settle as long as possible until they can be without danger submitted to the acetous fermentation; I then throw into the wine about thirteen drams (apoth.) of chloride of sodium per twenty-two gallons of that liquid. Either of the two herein-before described processes separately gives good results, but the combination of the two insures superior products in point of taste to those obtained by defecation, and is highly preferable as to the safety of the operation to those obtained by the alcoholic fermentation of the juice with all its ferments.

Acetification of the Vinous Juice.—For beet root vinegar made without defecation the temperature must not be higher than seventy-five to seventy-seven degrees Fahrenheit. Under a high temperature beet root wine while in a state more wine than vinegar becomes heated, and deteriorates rapidly if not at once transformed into vinegar. In proportion as the acetification advances the taste of beet root disappears. The juice prepared as herein-before described contains the sugar and salts of the beet root, and is free from its bad taste. The place most favorable for acetic fermentation is a cellar with thick walls, wherein the temperature may be kept at from seventy-seven to eighty-six degrees Fahrenheit. The air must be slowly changed by means of openings closed at pleasure. By increasing the point of contact between the air and the wine, vinegar may be obtained in about three days. The apparatus by which this result is obtained consists of a cylindrical cask,

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about six feet high and three feet in diameter, standing on an end. It is provided at about six inches from the lid with a false bottom, pierced at small intervals with several small conical holes, and supported by a hoop fixed inside the cask by pegs. In each of the holes in the false bottom is placed
5 a piece of string about six inches long, half closing it, and held by a knot. The liquid, introduced through a tube between the false bottom and the lid, leaks along these strings and drips into the interior of the cask, which is fitted with chips of beech tree, previously acetified with concentrated vinegar, on which the liquid falls and spreads itself, thus presenting to the action of
10 the air a very large amount of surface, which causes the wine to be rapidly acetified. In some places, instead of chips, corn steeped in vinegar for forty-eight hours is employed, and placed in layers six to seven inches thick upon five or six horizontal diaphragms pierced with holes. The air follows in an inverse direction, entering the cask through ten or twelve openings made
15 horizontally one inch or two from the lower bottom; it passes through the chips, and egresses from the cask by an opening made in the lid, which also serves to let in the alcoholic liquid. To complete the acetification, the liquid must generally be passed three times into these casks; it would be, therefore, well to employ for each series of operations three casks set one above the
20 other, the alcoholic liquid arriving in the highest cask, and successively passing from it into the other two below. This process is very expeditious, but the great quantity of air circulating through the liquid always occasions a considerable waste of alcoholic and acetic acid. This loss might be greatly lessened by applying to the upper lid of each cask a stone pipe for conveying
25 the air and the vapors carried away with it into a stone worm immersed in cold water, and kept cold by being continually changed. The alcoholic and acid vapors would by this means be condensed, and could then be added to the next liquid to be acetified. The worm or refrigerating apparatus should be placed in a room not heated, and separated from the stove for the acetic
30 fermentation by a wall or partition. The vinegar thus obtained should be put into large vats containing a sufficient supply of chips of beech tree previously acetified. The vats are then filled up and hermetically closed. Then, after having settled for twenty or twenty-five days on the chips, the vinegar is put into small casks ready for sale.
35 And having now described the nature of the Invention communicated to me, and the mode of carrying the same into effect, I would have it understood that I do not confine myself to the precise details herein laid down; but what I claim is,—

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First, the processes of treating beet root for the production of beet root wine for the purpose of its conversion into vinegar as herein-before described.

Secondly, the process of converting beet root wine so prepared into vinegar, as herein-before described.

In witness whereof, I, the said William Armand Gilbee, have hereunto set my hand and seal, this Seventeenth day of June, in the year of our Lord One thousand eight hundred and fifty-seven.

W. A. GILBEE. (L.S.)

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